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IN THE CLAIMS:

The following is a complete listing of the claims in this application, reflects all changes currently being made to the claims, and replaces all earlier versions and all earlier listings of the claims:

1. (Currently Amended) An ink jet recording head comprising:
  - a flat substrate having an end face and front and back flat main surfaces, said front and back flat main surfaces having a larger area as compared to the end face;
  - a discharge port formed above the front flat main surface of the substrate;
  - a wiring electrode connected to an energy generating member formed on the front flat main surface of the substrate, said energy generating member generating energy to be utilized to discharge ink from a said discharge port formed on the front flat main surface of the substrate;
  - a stepped surface provided at an end of the substrate and provided lower than the front flat main surface;
  - a connection electrode electrically connected to the wiring electrode and provided on the stepped surface;
  - an electrical wiring member superimposed on the connection electrode and electrically connected to the connection electrode through a bump electrode to supply an electrical signal or an electrical power to the connection electrode; and

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a sealing member for electrically conductively sealing and covering the connection electrode, the bump electrode, and the electrical wiring member on the stepped surface, ~~in such a manner that the connection electrodes, the bump electrode, and the electrical wiring member are vertically overlapped with each other through the bump electrode~~

wherein said sealing member does not extend beyond said discharge port in such a manner that the connection electrode, the bump electrode and the electrical wiring member are vertically overlapped, and

wherein the bump electrode is located between the connection electrode and the electrical wiring member.

2. (Previously Presented) The ink jet recording head according to claim 1, wherein the substrate is an insulation substrate made of a single crystal Si material, and wherein a pattern on a surface of the substrate is formed by anisotropic etching.
3. (Previously Presented) The ink jet recording head according to claim 2, wherein said stepped surface is located in an area of the substrate that becomes thinner in a stepwise fashion in a vicinity of the end face.
4. (Previously Presented) The ink jet recording head according to claim 3, wherein a surface of said stepped surface is parallel with the front flat main surface of the substrate.

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5. and 6. (Canceled)

7. (Original) The ink jet recording head according to claim 1, wherein the energy generating member is an electrothermal converting element for generating thermal energy.

8. (Original) The ink jet recording head according to claim 1, wherein the discharge port is disposed so as to face the energy generating member.

9. (Currently Amended) An ink jet recording apparatus comprising:  
an ink jet recording head having:  
a flat substrate having an end face and front and back flat main surfaces, said front and back flat main surfaces having a larger area as compared to the end face;

a discharge port formed above the front flat main surface of the substrate;

a wiring electrode connected to an energy generating member formed on the front flat main surface of the substrate, said energy generating member generating energy to be utilized to discharge ink from a said discharge port formed on the front flat main surface of the substrate;

a stepped surface provided at an end of the substrate and provided lower than the front flat main surface;

a connection electrode electrically connected to the wiring electrode and provided on the stepped surface;

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an electrical wiring member superimposed on the connection electrode and electrically connected to the connection electrode through a bump electrode to supply an electrical signal or an electrical power to the connection electrode;

a sealing member for electrically conductively sealing and covering the connection electrode, the bump electrode, and the electrical wiring member on the stepped surface, in such a manner that the connection electrodes, the bump electrode, and the electrical wiring member are vertically overlapped with each other through the bump electrode; and

wherein said sealing member does not extend beyond said discharge port in such a manner that the connection electrode, the bump electrode and the electrical wiring member are vertically overlapped, and

wherein the bump electrode is located between the connection electrode and the electrical wiring member; and

a member on which the ink jet recording head is mounted.

10. (Currently Amended) A method for sealing an electrode of an ink jet recording head, ~~said the~~ ink jet recording head comprising a flat substrate, ~~said the~~ flat substrate having an end face and front and back flat main surfaces, ~~said the~~ front and back flat main surfaces having a larger area as compared to the end face, a discharge port formed above the front flat main surface of the substrate, said the ink jet recording head further comprising a wiring electrode connected to an energy generating member formed on the front flat main surface of the substrate, ~~and an ink discharge port located above the front flat main surface, said method comprising the steps of:~~

providing a stepped surface at an end of the substrate such that the stepped surface is lower than the front flat main surface;

providing, on the stepped surface, a connection electrode electrically connected to the wiring electrode;

providing an electrical wiring member superimposed on the connection electrode and electrically connected to the connection electrode through a bump electrode to supply an electrical signal or an electrical power to the connection electrode;

and

electrically conductively sealing and covering, with a sealing member, the connection electrode, the bump electrode, and the electrical wiring member on the stepped surface, in such a manner that the connection electrodes, the bump electrode, and the electrical wiring member are vertically overlapped with each other through the bump electrode

wherein the sealing member does not extend beyond the discharge port in such a manner that the connection electrode, the bump electrode, and the electrical wiring member are vertically overlapped, and

wherein the bump electrode is located between the connection electrode and the electrical wiring member.

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REMARKS

This application has been reviewed in light of the Office Action dated October 31, 2003. Claims 1-4 and 7-10 are pending in this application. Claims 1, 9, and 10, which are the independent claims, have been amended to define still more clearly what Applicant regards as his invention, in terms that distinguish over the art of record. Favorable reconsideration is requested.

The Office Action objected to Claims 1, 9, and 10 as to matters of form relating to the claim language. Applicant has adopted the Examiner's recommendation to clarify the claims, i.e., to recite that the connection electrode, the bump electrode, and the electrical wiring member are vertically overlapped, wherein the bump electrode is located between the connection electrode and the wiring member. Applicant therefore respectfully requests withdrawal of this objection.

The Office Action rejected Claims 1 and 7-10 under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 6,325,488 B1 (Beerling et al.) in view of U.S. Patent No. 6,188,414 B1 (Wong et al.), and rejected Claims 2-4 as being unpatentable over Beerling et al. in view of Wong et al. and U.S. Patent No. 5,796,416 (Silverbrook). Applicant respectfully traverses these rejections.

Applicant submits that amended independent Claims 1, 9, and 10, together with the remaining claims dependent thereon, are patentably distinct from the proposed combination of the cited prior art at least for the following reasons.

The aspect of the present invention set forth in Claim 1 is an ink jet recording head comprising a flat substrate having an end face and front and back flat main surfaces, where the front and back flat main surfaces have a larger area as compared to the end face. The recording head also includes a discharge port formed above the front flat

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main surface of the substrate, a wiring electrode connected to an energy generating member formed on the front flat main surface of the substrate, where the energy generating member generates energy utilized to discharge ink from a discharge port, and a stepped surface provided at an end of the substrate and provided lower than the front flat main surface. A connection electrode of the recording head is electrically connected to the wiring electrode and provided on the stepped surface, and an electrical wiring member is superimposed on the connection electrode and electrically connected to the connection electrode through a bump electrode to supply an electrical signal or electrical power to the connection electrode. A sealing member electrically conductively seals and covers the connection electrode, the bump electrode, and the electrical wiring member on the stepped surface. The sealing member does not extend beyond the discharge port in such a manner that the connection electrode, the bump electrode and the electrical wiring member are vertically overlapped, with the bump electrode being located between the connection electrode and the electrical wiring member.

Among the notable features of Claim 1 are that the sealing member (see FIG. 1, reference numeral 70) electrically conductively seals and covers the connection electrode 50, the bump electrode 80, and the electrical wiring member 60 on the stepped surface, and the sealing member does not extend beyond the discharge port 40 in such a manner that the connection electrode 50, the bump electrode 80 and the electrical wiring member 60 are vertically overlapped. Since the top portion of the sealing member 70 does not project from the discharge port 40, the discharge port 40 may be located as close as possible to the recording medium to perform ink jet recording with high precision. (It is to be understood, of course, that the scope of Claim 1 is not limited to the details of this embodiment.)



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Beerling et al., as understood by Applicant, relates to an ink jet printhead for wide area printing. The Office Action, at page 5, states (and Applicant agrees) that Beerling et al. does not teach or suggest a sealing member, including a sealing member that does not extend beyond the discharge port. The Office Action at page 4 states that Beerling et al. discloses a connection electrode and wiring member vertically overlapped, with the bump electrode provided between them, and the Examiner states that Figure 11 provides support for this assertion. Applicant notes that in Beerling et al., Figure 11 is discussed from column 9, line 65, to column 11, line 31. In particular, the specification from column 10, lines 53-61, discusses a conducting layer (1113), substrate (1101), a thick layer (1109), and a thin layer (1111). Nothing, however, has been found in this section, or any other section, of the specification that would teach or suggest the features of a connection electrode, bump electrode and electrical wiring member being vertically overlapped, where the bump electrode is located between the connection electrode and the electrical wiring member, as recited in Claim 1.

Wong et al., as understood by Applicant, relates to an inkjet printhead with a preformed substrate. Initially, Applicant submits that nothing has been stated in the Office Action, and nothing has been found in Wong et al., that would teach or suggest a connection electrode, bump electrode and electrical wiring member being vertically overlapped, where the bump electrode is located between the connection electrode and the electrical wiring member. The Examiner relies on Wong et al., as stated in the Office Action at page 5, for teaching an ink jet print head having a sealing member which covers the electrical connections and does not extend beyond the discharge port. The Examiner asserts that FIG. 5B of Wong et al. provides support for this assertion, and reference numeral 110 of FIG. 5B provides support for the sealing member in particular. Applicant

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submits that FIG. 5B merely shows a wire 508 that conductively connects electrodes 211 and 510 arranged in a lateral direction, and nothing in FIG. 5B, or any other section or figure of Wong et al., would teach or suggest a sealing member that electrically conductively seals and covers the connection electrode, the bump electrode, and the electrical wiring member on the stepped surface, where each of these features are vertically overlapped.

Accordingly, Applicant submits that at least for the reasons discussed above, Claim 1 is patentable over the cited prior art, when taken separately or in any proposed combination.

Independent Claims 9 and 10 are apparatus and method claims, respectively, that correspond to the ink jet recording head of Claim 1, and are believed to be patentable for at least the same reasons as discussed above in connection with Claim 1.

A review of the other art of record, including Silverbrook, has failed to reveal anything that, in Applicant's opinion, would remedy the deficiencies of the art discussed above, as applied against the independent claims herein. Therefore, those claims are respectfully submitted to be patentable over the art of record.

The other rejected claims in this application depend from Claim 1 discussed above, and, therefore, are submitted to be patentable for at least the same reasons. Since each dependent claim is also deemed to define an additional aspect of the invention, individual reconsideration of the patentability of each claim on its own merits is respectfully requested.

In view of the foregoing amendments and remarks, Applicant respectfully requests favorable reconsideration and the allowance of the present application.

Applicant's undersigned attorney may be reached in our New York Office by telephone at (212) 218-2100. All correspondence should continue to be directed to our address listed below.

Respectfully submitted,

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